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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
EDWARDS, PATRICK L	
ART UNIT	PAPER NUMBER
2624	

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	02/20/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 02/20/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)
	10/090,746	OHISHI, SATORU
	Examiner	Art Unit
	Patrick L. Edwards	2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12-07-2006 has been entered.

Response to Arguments

2. Applicant's arguments filed on 12-07-2006 have been fully considered. A response to these arguments is provided below.

Prior Art Rejections

Summary of Argument:

Applicant has amended claim 1 to add the limitation of "a memory which stores a plurality of images." Applicant argues that this amendment gets around the cited prior art.

Examiner's Response:

The examiner notes that this particular limitation is not expressly disclosed by the Sato reference alone. However, the examiner notes that this limitation was presented in conjunction with a previous claim, and that claim was rejected over the combination of Sato and Slack. The combination of Sato and Slack will now be applied in the rejection to claim.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-3, 9-17 and 22-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sato and Slack (PN 6,487,432).

Regarding Claim 1: Sato discloses an X-ray diagnostic apparatus comprising:

- a designating section which designates a region of interest on not less than one image of a plurality of X-ray diagnostic images forming a moving image, when continuously displayed, on the basis of an input from an operator [Figs. 6 and 9. Figure 9 is referred to as opposed to Figure 5, but has the same steps (shown in Figure 6). Step 301 is where a user sets the region of interest (ROI,10) belonging to the object (9) (col. 6 lines 48-49).];

- a position estimating section which estimates corresponding areas on the remaining images of the plurality of images which correspond to the region of interest [Figs. 5, 6, and 9. The ROI control apparatus (17) determines the translational position and range (8) in step 303, which effectively estimates the region of interest (10) for all subsequent images (col. 6 lines 52-54).]; and

- a display section which displays the respective images in such a way as to shift the region of interest or the respective corresponding areas to an appropriate position [Figs. 5, 6, 9, and 11. The driving control apparatus (14) shifts the translational moving apparatus (18(a) and 18(b)) (col. 7 line 67 – col. 8 line 7) causing a translation in the detectors thereby producing a shifted image of the region of interest. The shift is performed in step 304 to center the ROI in the translational range (8) (col. 7 lines 3-5). Figure 11(a) shows how the display apparatus (16) is used to display the region of interest (10b) (col. 8 lines 34-37). Figure 11 (b) and (c) also demonstrate the display apparatus' ability to shift the region of interest to focus on a specific point designated by the operator, such as the points determined by the vectors R1 or R2 (col. 8 lines 37-58). In Figure 11(b) the display apparatus shifts in accordance with vector R1, while in Figure 11(c) the display apparatus shifts in accordance with vector R2.].

Sato does not disclose a memory for storing a plurality of images. However, Slack does teach this limitation

- a memory which stores a plurality of images [Slack, Figs. 2 and 3. The archive subsystem (54) stores the plurality of 2D images acquired (col. 3 lines 4-5). The data acquisition system (32), which acquires the 2D images, sends the images to an image reconstructor (34), which creates a 3D image (col. 2 lines 44-49). This reconstructed 3D image is then stored in a memory (38) (col. 2 lines 49-51).]; and

It would have been obvious to one of ordinary skill in the art to combine these references because Slack teaches the location of a region of interest from a large amount of image data (col. 1 lines 46-51) and Sato teaches only collecting the data in the ROI and reconstructing the ROI (col. 1 lines 60-61). Also one would have been motivated to make this combination to simplify the diagnosis process, since irrelevant data has been excluded, thereby shortening the time needed to make a diagnosis.

Regarding Claim 2: Sato discloses the apparatus according to claim 1, wherein the plurality of X-ray diagnostic images are images acquired by rotation around an object to be examined [Figs. 6 and 9. The rotational moving apparatus (19) is rotated in step 305 after each time an image is taken, so that an x-ray image may be taken at a

different angle (col. 6 lines 64-65 and col. 8 lines 2-5). An image is taken and the rotational moving apparatus (19) is rotated until a predetermined number is satisfied (col. 7 line 5-7).].

Regarding Claim 3: Sato discloses the apparatus according to claim 1, wherein the corresponding region on each of the remaining images is determined on the basis of at least one of the designated region of interest, an angle of an imaging system corresponding to each image, a distance between an X-ray source and an X-ray detector image-receiving surface, and a detector size [Figs. 6 and 9. The translational position and range (8) are determined by the ROI control apparatus (17) on the basis of the angle of an imaging system provided by the driving control apparatus (14) (col. 6 lines 49-54).].

Regarding Claim 9: Sato discloses the apparatus according to claim 1, further comprising display range adjusting section which adjusts a display range of an X-ray diagnostic image after the shift processing by using a shutter having a predetermined shape [The translational range (8) is adjusted in step 304 by the driving control apparatus as determined by the ROI control apparatus (17) in step 303 (col. 6 lines 49-64). This adjustment is performed after the shift which is also performed in step 304. A pre-collimator (2) acts as a shutter to convert the x-ray (5) into a fan-beam x-ray (5) (col. 6 lines 55-56). The fan shape of the x-ray beam (5) is the result of the pre-collimator having a predetermined shape.].

Regarding Claim 10: Sato discloses the apparatus according to claim 9, wherein the predetermined shape can be set to an arbitrary shape [Sato discloses the predetermined shape of the collimator to produce a fan-shaped beam. However, Sato's use of the phrase "According to a consideration" (col. 3 line 30) suggests that this shape is used as an example only and could be any other shape.]

<u>Regarding Claim 11</u>: Sato discloses an X-ray diagnostic apparatus comprising:

- a position estimating section which estimates corresponding areas on the plurality of 2D images which correspond to the region of interest on the basis of a position of the region of interest designated on the 3D image [The analogous arguments made regarding claim 1 are applicable to this position estimating section.]; and

- a display section which displays the respective images in such a way as to shift the region of interest or the respective corresponding areas to an appropriate position [Figs. 5, 6, 9, and 11. The driving control apparatus (14) shifts the translational moving apparatus (18(a) and 18(b)) (col. 7 line 67 – col. 8 line 7) causing a translation in the detectors thereby producing a shifted image of the region of interest. The shift is performed in step 304 to center the ROI in the translational range (8) (col. 7 lines 3-5). Figure 11(a) shows how the display apparatus (16) is used to display the region of interest (10b) (col. 8 lines 34-37). Figure 11 (b) and (c) also demonstrate the display apparatus' ability to shift the region of interest to focus

on a specific point designated by the operator, such as the points determined by the vectors R1 or R2 (col. 8 lines 37-58). In Figure 11(b) the display apparatus shifts in accordance with vector R1, while in Figure 11(c) the display apparatus shifts in accordance with vector R2.].

Sato does not disclose a memory for storing a 3D image or designating a region of interest on this 3D image. However Slack teaches a method for selecting and displaying medical image data comprising:

- a memory which stores a plurality of 2D images forming a moving image of a predetermined diagnosis target when continuously displayed and a 3D image of the predetermined diagnosis target [Slack, Figs. 2 and 3. The archive subsystem (54) stores the plurality of 2D images acquired (col. 3 lines 4-5). The data acquisition system (32), which acquires the 2D images, sends the images to an image reconstructor (34), which creates a 3D image (col. 2 lines 44-49). This reconstructed 3D image is then stored in a memory (38) (col. 2 lines 49-51).]; and
- a designating section which allows an operator to designate a region of interest on the 3D image [Slack, Fig. 4. The operator uses the reconstructed 3D image (104) to identify or designate a region of interest.].

It would have been obvious to one of ordinary skill in the art to combine these references because Slack teaches the location of a region of interest from a large amount of image data (col. 1 lines 46-51) and Sato teaches only collecting the data in the ROI and reconstructing the ROI (col. 1 lines 60-61). Also one would have been motivated to make this combination to simplify the diagnosis process, since irrelevant data has been excluded, thereby shortening the time needed to make a diagnosis.

Regarding Claim 12: Sato and Slack disclose the apparatus according to claim 11, wherein the plurality of 2D images are images acquired by rotation around an object to be examined [The analogous arguments of claim 2 are applicable to claim 12.].

Regarding Claim 13: Sato and Slack disclose the apparatus according to claim 11, wherein each of the corresponding areas on the plurality of 2D images is determined on the basis of at least one of the designated region of interest, an angle of an imaging system corresponding to each image, a distance between an X-ray source and an X-ray detector image-receiving surface, and a detector size [The analogous arguments of claim 3 are applicable to claim 13.].

Regarding Claim 14: Sato and Slack disclose the apparatus according to claim 11, further comprising display range adjusting section which adjusts a display range of a 2D image after the shift processing by using a shutter having a predetermined shape [The analogous arguments of claim 9 are applicable to claim 14.].

Regarding Claim 15: Sato and Slack disclose the apparatus according to claim *14*, wherein the predetermined shape can be set to an arbitrary shape [The analogous arguments of claim 10 are applicable to claim 15.].

Regarding Claim 16: Sato and Slack disclose an image processor comprising:

- a memory which stores a plurality of images forming a moving image when continuously displayed [The analogous arguments of claim 11 are applicable.];
- a designating section which allows an operator to designate a region of interest on not less than one of the plurality of images [The analogous arguments of claim 1 are applicable.];
- a position estimating section which estimates corresponding areas on the remaining images of the plurality of images on the basis of a position of the designated region of interest [Sato, Figs. 5, 6, and 9. The ROI control apparatus (17) determines the translational position and range (8) in step 303, which effectively estimates the region of interest (10) for all subsequent images (col. 6 lines 52-54). The translation range (8) is determined based on the width of the designated ROI (col. 3 lines 48-49).]; and
- a display section which displays the respective images in such a way as to shift the region of interest or the respective corresponding areas to an appropriate position [The analogous arguments of claim 1 are applicable.].

Regarding Claim 17: Sato and Slack disclose the processor according to claim 16, wherein the plurality of images are images acquired by rotation around an object to be examined [The analogous arguments of claim 2 are applicable to claim 17.].

Regarding Claim 22: Sato and Slack disclose the processor according to claim 16, further comprising a display range adjusting filter which adjusts a display range of an image after the shift processing by using a shutter having a predetermined shape [The analogous arguments of claim 9 are applicable to claim 22.].

Regarding Claim 23: Sato and Slack disclose the processor according to claim 22, wherein the predetermined shape can be set to an arbitrary shape [The analogous arguments of claim 10 are applicable to claim 23.].

Regarding Claim 24: Sato and Slack disclose an image processor comprising:

- a memory which stores a plurality of 2D images forming a moving image of a predetermined diagnosis target when continuously displayed, and a 3D image of the predetermined diagnosis target;
- a designating section which allows an operator to designate a region of interest on the 3D image;

- a position estimating section which estimates corresponding areas on the plurality of 2D images which correspond to the region of interest on the basis of a position of the region of interest designated on the 3D image; and
- a display section which displays the respective images in such a way as to shift the region of interest or the respective corresponding areas to an appropriate position.

[The analogous arguments of claim 11 are applicable to claim 24.].

Regarding Claim 25: Sato and Slack disclose the processor according to claim 24, wherein the plurality of 2D images are images acquired by rotation around an object to be examined [The analogous arguments of claim 2 are applicable to claim 25.].

Regarding Claim 26: Sato and Slack disclose the processor according to claim 24, wherein each of the corresponding areas on the plurality of 2D images is determined on the basis of at least one of the designated region of interest, an angle of an imaging system corresponding to each image, a distance between an X-ray source and an X-ray detector image-receiving surface, and a detector size [The analogous arguments of claim 3 are applicable to claim 26.].

Regarding Claim 27: Sato and Slack disclose the processor according to claim 24, further comprising display range adjusting means for adjusting a display range of a 2D image after the shift processing by using a shutter having a predetermined shape [The analogous arguments of claim 9 are applicable to claim 27.].

Regarding Claim 28: Sato and Slack disclose the processor according to claim 27, wherein the predetermined shape can be set to an arbitrary shape [The analogous arguments of claim 10 are applicable to claim 28.].

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato in view of Rougee et al. (PN 5,699,446). (hereinafter Rougee)

Regarding Claim 4: Sato discloses the apparatus according to claim 1 having a position estimating section, but does not disclose the position estimating section to obtain and project a 3D position. However, Rougee discloses a method wherein when areas of interest are designated on not less than two X-ray diagnostic images, said position estimating section obtains a 3D position of a diagnosis target on the basis of straight lines connecting focal positions of an X-ray source in sensing the respective images on which the areas of interest are designated and the areas of interest, and projects the 3D position onto the remaining images of the plurality of images, thereby estimating the respective corresponding areas [Fig. 2. The points 24 and 28 are the designated areas of interest on the x-ray images 20 and 21, taken at focal positions 18 and 19, respectively (col. 4 lines 50-56 and col. 5 lines 8-10). The lines 18-24

and 19-28, which connects the focal positions with their respective area of interests are used to compute the 3D position of the diagnosis target (locus, 25) (col. 5 lines 17-21). The 2D positions of the area of interest are then displayed (col. 5 lines 28-31). This position is projected on each of the rotational images (col. 6 lines 8-10).]. It would be obvious to one of ordinary skill in the art to modify Sato's position estimating section to obtain a 3D position and project the position as taught by Rougee because Sato desires to only collect penetrating data through a region of interest (col. 1 lines 46-48 and 57-61). Furthermore, one would be motivated to make this modification because projecting the three dimensional point on the remaining images estimates the corresponding areas of interest thereby reducing the data collected and shortening the time needed to acquire the images.

6. Claims 5-7 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato in view of Chen et al. (PN 6,047,080). (hereinafter Chen)

Regarding Claim 5: Sato discloses the apparatus according to claim 1 designating an area of interest, but does not disclose using a function of the designated areas on two images to obtain areas on the remaining images. However, Chen discloses a method of 3D reconstruction wherein when areas of interest are designated on not less than two X-ray diagnostic images, said position estimating section calculates a locus of the areas of interest in the moving image by using a function on the basis of the respective designated areas of interest, and obtains the corresponding areas on the remaining images on the basis of the locus [Figs. 1 and 4. The two images (V and V') containing areas of interest are acquired. These two views are used by a position estimating section (32) to establish the corresponding areas of interest or image features (col. 10 lines 12-16). Several methods of estimating the areas of interest are disclosed depending on the degree of noise (col. 12 lines 9-11). These methods rely on various functions to calculate a locus of the areas of interest (Equations 3 and 4).]. It would be obvious to one of ordinary skill in the art to modify Sato with Chen because Sato teaches the desire to avoid scanning the entire ROI in 3D reconstruction (col. 1 lines 46-48) and Chen teaches the use of just two images for reconstructing 3D structures (col. 2 lines 42-44). Furthermore, one would be motivated to make this modification because Chen's method of calculating the corresponding areas of interest between those that are designated allows accurate 3D reconstruction in a shorter period of time because fewer images are needed. Chen's method allows the step size between rotations to be larger reducing the number of times an image is taken, which is a time consuming process.

Regarding Claim 6: Sato as modified by Chen disclose the apparatus according to claim 5, wherein said position estimating section includes an interface *which* switches the function by manual operation [Chen. The position estimating section (32) as explained in claim 5 has several available methods, such as a linear algorithm (col. 10 lines 41-46) and an objective function (col. 12 lines 9-18). It is understood from the use of the word "employ" that a user would choose which method would be implemented depending on the noise of the data.]

Regarding Claim 7: Sato as modified by Chen disclose the apparatus according to claim 5, wherein said position estimating section selects a function to be used in accordance with the number of areas of interest designated by an operator [Chen. Equations 3 and 4 contain a variable n, which is representative of the number of areas of interest (points extracted) (col. 12 lines 30-31).].

Regarding Claim 18: Sato as modified by Chen discloses the processor according to claim 16, wherein said position estimating section calculates a locus of the region of interest on the moving image by using a function on the basis of the designated region of interest, and obtains the corresponding areas on the remaining image on the basis of the locus [The analogous arguments of claim 5 are applicable to claim 18.].

Regarding Claim 19: Sato as modified by Chen discloses the processor according to claim 18, wherein said position estimating section includes an interface which switches the function by manual operation [The analogous arguments of claim 6 are applicable to claim 19.].

Regarding Claim 20: Sato as modified by Chen discloses the processor according to claim 18, wherein said position estimating section selects a function to be used in accordance with the number of areas of interest designated by the operator [The analogous arguments of claim 7 are applicable to claim 20.].

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato in view of Mori et al. (PN 4,868,747). (hereinafter Mori)

Regarding Claim 8: Sato discloses the apparatus according to claim 1 having a position estimation section, but does not disclose the position estimation section performing correlation. However, Mori discloses a computed tomography method wherein said position estimation section performs correlation value computation associated with pixel values in the region of interest between not less than two adjacent images of the plurality of X-ray diagnostic images, and obtains the corresponding areas on the respective remaining *images* on the basis of the correlation values [Fig. 9. The CT number averaging circuit (56) computes the average pixel value of a region of interest in each of at least two CT images (col. 4 lines 60-62). The CT interpolating circuit (57) then correlates the two average values of the regions of interest by interpolation (col. 4 lines 62-65). The results of interpolation yield the pixel values of the regions of interest in the remaining CT images.]. It would be obvious to one of ordinary skill in the art to modify Sato with Mori because Sato teaches high resolution 3D reconstruction of a region of interest in a short time (Sato, col. 1 lines 12-33). One would be motivated to make this modification because interpolating to find the regions of interest allows for a more accurate reconstruction without necessitating the time consuming process of taking more images (Mori, col. 5 lines 1-3).

8. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sato and Slack in view of Mori.

Regarding Claim 21: The combination of Sato and Slack as modified by Mori discloses the processor according to claim 16, wherein said position estimation section performs correlation value computation associated with pixel values in the region of interest between not less than two adjacent images of the plurality of X-ray diagnostic images, and obtains the corresponding areas on the respective remaining areas on the basis of the correlation values [The analogous arguments of claim 8 are applicable to claim 21.].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick L. Edwards whose telephone number is (571) 272-7390. The examiner can normally be reached on 8:30am - 5:00pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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